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The Effect of Rice Bran Milk on Low Density Lipoprotein (LDL) Concentration in Diabetic Rats

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Abstract

Dyslipidemia common in insulin resistance in patients with diabetes, with increased Low Density Lipoprotein (LDL) concentration. Rice bran has antioxidants which can reduce of LDL concentrations in the body. This research aimed to determine the effect of rice bran milk on Low Density Lipoprotein (LDL) concentration in diabetic rats. This research is a true experiment design study using a pre-post test with control group design. A total of 20 rats were divide into 4 groups. Group 1 (Negative Control) Diabetic rats, Grup 2 (Positive Control) Glibenclamide, Group 3 Rice Bran Milk 30 gram and Group 4 Rice Bran Milk 60 gram for 14 days. Data was analyzed using Pairet t-test and One Way Annova test. The research is showed no significant differences in LDL concentrations before and after treatment in the control group and treatment group with p value 0.61>0.05. However, in the group given rice bran milk was increased concentrations of LDL but not as high as in the control group with an average increase of respectively 1.60 mg/dL and 0.20 mg/dL.

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Conclusions: there is no significant effect before and after giving of rice bran milk on Low Density Lipoprotein (LDL) concentrations, but there was an increase in LDL concentration was lower in the treatment groups compared with the control groups after giving rice bran milk. Recommedation: the next research to increase the time for giving in rice bran milk to get maximum results. Decreasing LDL concentratios can be prevent the risk of atherosclerosis.

Keywords: Rice Bran Milk; LDL; Diabetic; Rats.

1. Introduction

Non Communicable Diseases (NCD) have become a major concern in public health problems. Non Communicable Diseases (NCD) have become the leading cause of death globally at this time [1]. Diabetes mellitus is one of the non-communicable diseases whose prevalence is expected to continue to increase from year to year. Diabetes mellitus is a group of metabolic diseases with characteristics of chronic hyperglycemia that occur due to abnormal insulin secretion, insulin work or both [2]. In 2017, Indonesia was ranked sixth with 10.3 million people with diabetes mellitus (8.9-11.1%) at the age of 20-79 years [3].

Insulin resistance or metabolic syndrome and diabetes mellitus can cause abnormalities of lipid metabolism characterized by an increase or decrease in the plasma lipid fractions (dysplidemia). Dyslipidemia common in insulin resistance in patients with diabetes, with the characteristics of the increase in Very Low Density Lipoprotein (VLDL) or triglycerides, decreased High Density Lipoprotein (HDL) and the formation of atherogenic of small dense Low Density Lipoprotein (LDL) [4]. This condition can be a factor in the increase of atherosclerotic disease. Based on data from Riskesdas (2013) on a population of ≥15 years showed that more than 15.9% of Indonesia's population had high and very high LDL concentrations of 17.9% [5].

The increase in prevalence in some diseases, especially NCD, has led to changes in people's attitudes, which tend to be trying to prevent the disease and implement healthylifestyle. The emergence of functional food products can be an alternative in preventing several types of diseases that arise both due to genetic factors, lifestyle and diet. One functional food that has the potential to be used as functional food is rice bran [6].

Rice Bran is a by product of the rice milling process. The percentage of bran from milled dry grain is around 10% [7]. Giving rice bran is reported to have a good effect on decreasing LDL and increasing HDL in patients with diabetes **[**8]. One popular form of functional food is in the form of drinks. This is because processing in the manufacture of drinking is not much so that the nutrient content in the beverage is maintained. In addition, functional food in the form of drinks is also considered practical.

Production of drinks from bran, rice bran milk, into functional drinks is one alternative that appeals to the added value of bran it self [9]. Experiments of a hyperglycemic using experimental animals are rats (Rattus Norvegicus*)* wistar. Animal models of diabetic can be done by injecting Alloxan. Alloxan is a chemical that is given to produce experimental diabetic in various vertebrate [10]. This research aimed to determine the effect of rice bran milk on Low Density Lipoprotein (LDL) concentration in diabetic rats.

2. Materials and Methods

2.1. Location and Design

The research was conducted in May-August 2018. The process of adaptation and treatment is carried out at Biopharmaceutical Laboratory of the Faculty of Pharmacy, Hasanuddin University. This research is a true experiment design study using a pre-post test with control group design.

2.2. Sample Research

A total 20 rats were divide into 4 groups. Group 1 (Negative Control) Diabetic rats, Grup 2 (Positive Control) Glibenclamide, Group 3 Rice Bran Milk 30 gram and Group 4 Rice Bran Milk 60 gram.

2.3. Method of Collecting Data

The process of adaptation conducted of 1 month. Adaptation was carried out to increase rats body weight to 180 gram so that alloxan injection could be carried out. Rats were injected using alloxan 140 mg/kg body weight for diabetic rats. Rats declared diabetic if fasting blood sugar concentration were as ≥ 126 mg/dL. Then, the checking of LDL concentration before of giving rice bran milk. The giving of rice bran milk for 14 days. After that the checking of LDL concentration after giving of rice bran milk. Low Density Lipoprotein (LDL) concentration checks were carried out at Balai Besar Laboratorium Makassar using Direct Method by using tools Thermo Scientific Indiko Automatic Analyzer.

2.4. Data Analysis

Analysis of data using Pairet t-test and One Way Annova test in SPSS program to see the effect of rice bran milk on LDL concentration in diabetic rats.

3. Results

3.1. Low Density Lipoprotein (LDL) Concentration in Diabetic Rats

Mean of Low Density Lipoprotein (LDL) Concentration in Diabetic Rats as presented in table 1.

Table 1: Low Density Lipoprotein (LDL) Concentration in Diabetic Rats

Group Treatment		LDL Concentrations (mg / dL)		% Change
		Pre-test	*Post-test*	
		mean	mean	
1	Diabetic Rats (Negative Control)	9.40	15.60	65.95
2	Glibenclamide (Positive Control)	8.20	12.60	53.65
3	Rice bran Milk 30 g	12.20	13.80	13.11
4	Rice bran Milk 60 g	10.20	10.40	1.96

n = 5

Based on table 1, shows in group 1 the average LDL concentration before treatment was 9.40 mg/dL and after treatment increased to 15.60 mg/dL with an increase of 65.95%. Group 2 also increase before treatment of 8.20 mg/dL increased to 12.60 mg/dL after treatment with an increase in LDL concentrations of 53,65%. Whereas in group 3 there was an increase in the average LDL concentration of 12.20 mg/dL at the before treatment to 13.80 mg/dL after treatment with an increase in LDL concentration of 13.11% and group 4 the LDL concentration of 10.20 mg/dL also increased in LDL concentration only reached 1.96%. The LDL concentrations before and after treatment in the control group and treatment group as presented in Figure 1.

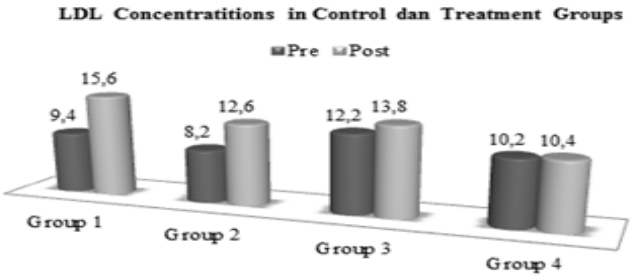

Figure 1: LDL oncentrations before and after treatment in the control group and treatment group

3.2. Effect of Rice Bran Milk on Low Density Lipoprotein (LDL) Concentration in Diabetic Rats

The effect of Rice Bran Milk on Low Density Lipoprotein (LDL) Concentration in Diabetic Rats as presented in table 2.

Table 2: The effect of Rice Bran Milk on Low Density Lipoprotein (LDL) Concentration in Diabetic Rats

Group Treatment		LDL Concentration (mg / dL)		Δ mean	p Value
		Pre-test mean	*Post-test* mean		
1	Diabetic Rats (Negative Control)	9.40	15.60	6.20	0,027 *
2	Glibenclamide (Positive Control)	8.20	12.60	4.40	0,046 *
3	Rice bran Milk 30 g	12.20	13.80	1.60	0,645 *
4	Rice bran Milk 60 g	10.20	10.40	0.20	0.621 *
p Value		0.353 **	0.361 **		

* Paired t-test

** One-Way ANOVA test

Based on table 2, shows the result of the paired t-test is significant differences berofe and after treatment in group 1 and group 2. In group 1 diabetic rats (negative control) shows the p value 0.027 ($p<0.05$) and group 2 glibenclamide (positive control) shows the p value 0.046 ($p<0.05$). While in the group given rice bran milk has no significant berofe and after treatment, namely in group 3 rice bran milk 30 gram shows p value 0.645

(p>0.05) and group 4 rice bran milk 60 gram shows the p value 0.621 (p>0.05). Besed on the result of the one way anova test, its showed that there were no significant differences in LDL concentrations before and after treatment in the control group and treatment group with p value 0.361>0.05.

4. Discussion

Rice bran milk is one of the products of the use of rice bran which can be used as one of functional foods that are expected to provide better helat effects, especially in decreasing LDL concentrations which can reduce the risk of aterosclerosis. The experimental animals used in this research are rats that will be made into diabetic with alloxan injection 140 mg/kg bodi weight. Rats expressed increased diabetic when blood glucose of 126 mg/dL. After rats was diabetic then was checking of the LDL concentration and then by giving treatment to the 4 groups for 14 days.

In this research the treatment group was divided into 4 groups, namely group 1 diabetic rats (negative control), group 2 glibenclamide (positive control), grup 3 rice bran milk 30 gram, and group 4 rice bran milk 60 gram. In group 1 and group 2 was a significant differences to LDL concentrations before and after treatment with each value of (p>0.05). In both groups there was a significant increase in LDL concentrations of 6.20 mg/dL and 4.40 mg/dL. Whereas in group 3 and group 4 were given rice bran milk bran showed that no significant difference to LDL concentrations in diabetic rats before and after feeding rice bran milk with each value of (p>0.05). However, in the group given 30 gram of rice bran milk and 60 gram rice bran milk was increased concentrations of LDL but not as high as in the control group with an average increase of respectively 1.60 mg/dL and 0.20 mg/dL.

Metabolic abnormalities in diabetes occurs because of insulin resistance that affects the body's metabolic process sucg as changes to plasma lipoprotein. In fat tissue there is a decrease in the effect of insulin so that lipogenesis is reduced and lipolysis increases. This will lead to glucotoxicity with lipotoxicity which causes an increase in LDL concentration. In a state of hyperglycemia, LDL oxidation is faster. Increased LDL concentration in blood is one of the cause of health problems, especially cardiovascular disease and atheroslerosis [4]. LDL oxidation process will result in an increase of LDL concentration in the blood.

Previous research with modification of rice bran into drinks showed changes in positive LDL concentrations even with defferent results. Research conducted in type 2 diabetes patients showed a decrease in LDL concentration. The result showed no significant effect on the administration of modified Rice Bran Oil (RBO) into milk with value of (p>0.05) buat a decrease in LDL concentration after consuming 18 g of modified Rice Bran Oil (RBO) from every day for 5 weeks [11]. Research conducted by Nirmala (2012) showed that administration of Ready to Drink Rice Bran Oil - Chocolate Beverange on Plasma Lipid In Obese College Students for 15 days by giving as much as two cups a day showed a decrease in plasma LDL cholesterol before and after intervention of 102.1 mg/dL and 83.4 mg/dL. There was a decrease in LDL cholesterol of 18.7 mg/dL with value of (p=0.033) [12].

Previous research showed that the giving of rice bran with a modified form had a good impact on decreasing

LDL concentration. This research was conducted by giving rice bran in the form of drink to the subject to see changes in LDL concentration. Giving of rice bran milk in this study is as much 1x a day for 14 days in the morning, in contrast to previous studies which provided 2 cups of Ready to Drink Rice Bran Oil - Chocolate Beverange in a day. Therefore, there was a difference in the frequency of rice bran in this research. Giving of rice bran milk for 14 days has a positive effect on LDL concentrations, which is a lower LDL concentration compared to the control group. In the group given 30 gram of rice bran milk showed a lower increase in LDL concentrations before and after treatment of 12.20 mg/dL and 13.80 mg/dL. An increase of 1.60 mg/dL. While in the group given 60 gram of rice bran milk which was 10.20 mg/dL to 10.40 mg/dL. There was an increase of 0.20 mg/dL, lower than the control group and the 30 gram rice bran milk group. This shows that the hinger the dose of rice bran milk can cause a decrease in LDL concentration even though it is also necessary to increase the treatment time.

Research related to the giving of rice bran from extract also showed a decrease in LDL concentrations in experimental animals. Others research conducted by Sueratman (2018) showed that giving of rice bran extract as 30 gram for 21 days to obese Sprague Dawley Rats showed significant with value ($p=0.028$) with a decrease in LDL concentration of 6.38%. Giving rice bran extract with a dose of 60 gram and 90 gram are also showed significant results ($p=0.000$). The LDL concentrations decline with increasing doses indicated intervention rice bran extract [13]. In this research, it was shown that administration of higher doses of rice bran milk was 30 gram and 60 gram was able to reduce the increase in LDL concentration by increasing the dose given even though thre was no difference before and after the giving of rice bran milk in the control group and treatment group. Both of these researchs show that doses of 30 gram and 60 gram of rice bran can improve the concentration of LDL for the better, with increasing doses the more suppress the increase in LDL concentration. The giving of rice bran in the form of milk or extracts with doses of 30 gram and 60 gram showed changes in LDL concentration. Although in giving rice bran in the form of milk showed no significant effect.

Previous research showed that giving of rice bran extract for 21 days had a significant effect on changes in LDL concentration. Whereas in this study despite changes in LDL concentration after giving of rice bran milk for 14 days, this change in concentration still did not show significant differences. The difference in trearment time is thought to be one of the cause of the absence of a significant effect on the giving of rice bran milk. So, that it can be concluded that giving longer treatment can cause a decrease in LDL concentration in the body.

In this research there was increase in LDL concentration in the group given rice bran milk but not as in the control group. This can be caused by some of the content of antioxidants and fiber found in the rice bran milk. The main antioxidants in rice bran is γ-orizanol which is composed of a mixture of ferulic acid ester and phytosterols [14]. Antioxidants and dietary fiber from rice bran can increase the activity of the cholesterol-7α-hydroxylase enzyme that can contribute to cholesterol reduction in the liver [15]. Reduction of cholesterol in the liver leads to stimulation of the enzymatic activity of 3-hydroxy-3-methylglutaryl coenzyme A (HMG-CoA) reductase inhibitors to increase the synthesis of endogenous cholesterol [16]. Increased excretion of bile acids in the enterohepatic decline. The liver will produce bile acids by drawing more cholesterol in the blood, so that the concentration of cholesterol in the blood decreases [17]. Decreasing cholesterol concentration in the blood will cause an increase in the concentration of HDL cholesterol which causes a decrease in LDL concentration in the

body.

The research of Wilson and his colleagues (2007), showed the groups given diets containing γ-orizanol and rice bran oil showed a significant downward trend for lipid hydroperoxide and plasma triglyceride levels. This study revealed that γ-orizanol have a better potential for lowering the concentration of LDL and VLDL as well as maintaining the lipid profile by increasing HDL cholesterol [18]. The previous research have shown that the giving of rice bran milk with a relatively long time has a positive effect with a decrease in LDL concentration, the special addition of γ-orizanol to the treatment led to a downward tren in lipid hydroperoxidation and plasma triglyceride levels. So that it can reduce and maintain LDL concentration in the body. In the research, rice bran milk mixed with several additional ingredients such as cocoa, honey, and creamer. There was no examination of γ-orizanol in pure rice bran milk products and rice bran milk which had been mixed with several additional ingredients. So that it is not know for certain whether these additives can accelerate or otherwise become inhibitors of absorption and metabolism of rice bran milk given.

The are several factors that can cause no significant effect of rice bran milk on LDL concentratios. Gallaher and his colleagues (2000) reported that some cholesterol absorption of cholesterol metabolism showes inconsistent result that could be influenced by genetic factors and other factors such as gender, diet, weight, physical activity, stress, and pathological factors [19]. Many factors may cause not maximum absorption and metabolism of feeding rice bran milk so as not to yield significant result to changes in the LDL concentrations.

In addition, previous research have shown that the administration of rice bran with a relatively long time has a positive effect with a decrease in LDL concentration which can lead to a downward tren in lipid hydroperoxidation and plasma triglyceride leveld. So that it can reduce and maintain LDL concentration in the body. Currently, the utilization of rice bran as a functional food is still hampered by several obstacles, including a lack of public awareness about the benefits of rice bran, the quality of rice bran that has not been standardied and many industries that have not beeb interesred in developing of rice bran. This situation is very different from a few countries in the world that has developed a rice bran as food products such as cereals and Rice Bran Oil (RBO) [20]. Production of rice bran drink into one instant healthy drinks made from rice bran is still lacking. With the presence of rice bran milk as one of the healthy instant drinks, it can be an attractive alternative to the added value from the rice bran products.

5. Conclusions

There is no significant effect before and after giving of rice bran milk on Low Density Lipoprotein (LDL) concentrations , but there was an increase in LDL concentrations was lower in the treatment groups compared with the control groups after giving rice bran milk. This research showed positive results even though there was no significant effect.

6. Recommedation

The giving of rice bran milk in 14 days showed a lower increase in LDL concentrations in the treatment group that the control group, although there was no significant effect, it was expected that the next research to increase

the time for giving in rice bran milk to get maximum results. Decreasing LDL concentratios can be prevent the risk of atherosclerosis. The limitation of this research is the time for giving rice bran milk is relatively short so that there is no significant effect on changes in LDL concentration.

7. Conflict of Interest

Author declare no conflict interest.

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